Bacteria -> Gram+ -> Rod -> Bacilus

* Ubiquitous, rapidly growing
* Produce endospores

*Bacillus antracis*

* First bacteria proven by Koch’s Postulates
* Facultative anaerobe
* Cells have squared ends while endospores are ellipsoidal shaped
* Mainly disease of herbivores

**Inoculation**

* Spores introduced through exposed skin
* Edema -> painless papule -> necrotic eschar
* Mortality – 20% if untreated

**Ingestion**

* Common in livestock
* Symptoms correlate with site of infection

**Inhalation**

* Spores inhaled and ingested by macrophage
* Migrate to lymph node where they escape and enter circulation
* Edema, Lymphoadenopathy, meningeal involvement and shock
* If untreated – 90% mortality

**Virulence Factors**

* Unique Polypeptide capsule
  + Protects against phagocytosis
* Anthrax toxins
  + PA, EF, LF
  + Need all 3 for edema, necrosis and lethality

**Diagnosis**

* Microscopic examination
* Grown on nonselective medium

**Treatment**

* Initiate ASAP with Ciprofloxacin, Doxycycline, and Amoxicillin
* Vaccine – Biothrax is only for high-risk pts

*Bacillus cereus*

* “Short-incubation” food intoxication
  + Nausea, vomiting, abdominal cramps
  + Occurs within 1-6 hours
* “Long-incubation” food intoxication
  + Abdominal cramps and diarrhea
  + Occurs within 8-16 hours
* Can cause ocular infections
  + Loss of sight within 48 hours

*Bacillus thuringiensis*

* Can also infect the eye

Bacteria -> Gram+ -> Rod -> Clostridium

*Clostridium botulinum*

* Fastidious anaerobic
* Ubiquitous in soil and water
* A-B type toxin
* Produces the botulinum toxin

**Infant botulism**

* Spores germinate in LI producing toxin
* Serious and rare and involve <1 yr olds
* Constipation, lethargy, & poor feeding
* T: no antibiotics, antitoxin if early enough

**Wound botulism**

**Food-borne botulism**

* Caused by ingestion of toxin in food
* Double vision, difficulty swallowing, muscle weakness, paralysis of breathing muscles
* Symptoms within 6 h – 2 weeks

**Inhalational botulism**

* Bioterrorism release

**Iatrogenic botulism**

* Accidental OD of the toxin

**Diagnosis**

* Physical signs, history & detection of toxin

**Treatment**

* Supportive care (especially breathing)
* Antitoxin must be early enough

**Prevention**

* Proper food handling

*Clostridium tetani*

* Small, motile, fastidious anaerobic
* Two toxins: Tetanolysin + Tetanosporin

**Tetanus**

* Localized Tetanus
  + Muscle contraction in injury area
* Cephalic Tetanus
  + Involves cranial nerves
* Generalized Tetanus
  + Lockjaw followed by neck stiffness
  + Temp rise, sweating, high BP, rapid HR
* Spasms occur frequently 3-4 x week

**Treatment**

* Debridement of primary wound
* Anti-toxin if early enough
* Prophylactic immunization
* Natural infection yields no immunity

*Clostridium perfringens*

* Large anaerobic, non-motile, active metabolism
* Produces 12 toxins
  + α – increases vascular permeability
  + β – Necrotic Lesions
  + ε – Forms permease
  + ι – Increases vascular permeability

**Perfringens food poisoning**

* Intense abdominal cramps and diarrhea
* Presents within 8-24 hours

**Necrotic Enteritis**

* Ingestion of large numbers of bacteria causes necrosis of the intestines

**Cellulitis**

* Infection of dead skin/CT

**Clostridial myonecrosis**

* Trauma impairs blood supply and causes bacterial growth leading to release of toxin
* Degrades the surrounding tissue
* Leads to shock, renal failure, death

**Treatment**

* Surgical debridement
* High dose penicillin
* Start therapy ASAP with proper wound care

*Clostridium difficile*

* Part of normal flora that can overgrow
* Two toxins
  + A – Enterotoxin
  + B – Cytotoxin
    - Destruction of cytoskeleton
* Be wary of new hypervirulent strain

**Pseudomembranous colitis**

* Leukocyte infiltration into lamina propria
* Forms patches on mucosa

**Diagnosis of CDAD**

* Display clinically significant diarrhea
* Positive test for CDAD
  + Anaerobic culture, PCR, Colonscopy, Glutamate dehydrogenase
  + Enzyme immunoassay – Best

**Treatment**

* Stop the offending bacteria
* Metronidazole and Vancomycin if severe